

CLAIMS

What is claimed is:

- 1 1. An integrated optical isolator device, comprising:
 - 2 a planar optical substrate;
 - 3 a first waveguide formed in said optical substrate and having an input
 - 4 section and an output section; and
 - 5 an isolator element affixed to said optical substrate and positioned in an
 - 6 optical path of said first waveguide between said input section and said output
 - 7 section, said isolator element being configured to allow the passage of forwardly
 - 8 traveling light from said input section to said output section of said first
 - 9 waveguide while inhibiting the passage of backwardly traveling light from said
 - 10 output section to said input section.
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- 1 2. The device of claim 1, further comprising a trench formed in said optical
- 2 substrate, said trench being oriented transversely with respect to a longitudinal
- 3 axis of said first waveguide, and wherein said trench receives and holds a lower
- 4 end of said isolator element.
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- 1 3. The device of claim 1, further comprising a second waveguide formed in said
- 2 optical substrate and having an input section and an output section, and wherein
- 3 said optical isolator element is further positioned in an optical path of said
- 4 second waveguide between said input section and said output section of said
- 5 second waveguide.
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- 1 4. The device of claim 1, wherein said isolator element comprises at least one
- 2 Faraday rotator layer interposed between birefringent layers.
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1 5. The device of claim 1, wherein said input section includes a first taper section
2 for expanding forwardly traveling light from a first mode size to a second mode
3 size.

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1 6. The device of claim 1, wherein said first taper section is substantially
2 adiabatic.

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1 7. The device of claim 5, wherein said output section includes a second taper
2 section for contracting forwardly traveling light from said second mode size to a
3 third mode size.

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1 8. The device of claim 1, wherein a long axis of said isolator element is oriented
2 perpendicular to an optical axis of said first waveguide.

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1 9. The device of claim 2, wherein said trench extends partially through a
2 thickness of said optical substrate.

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1 10. The device of claim 2, wherein said optical substrate is affixed to an
2 underlying support substrate, and said trench extends fully through a thickness
3 of said optical substrate and partially into a thickness of said support substrate.

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1 11. The device of claim 1, wherein said first waveguide has an associated mode
2 center located at least 30 microns below an upper major surface of said optical
3 substrate.

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1 12. The device of claim 1, wherein said input and output sections of said first
2 waveguide are formed simultaneously in said optical substrate.

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1 13. The device of claim 1, wherein said optical substrate is formed from a glass.

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1 14. The device of claim 1, wherein said first waveguide is formed by field
2 assisted ion-exchange.

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1 15. The device of claim 2, wherein said planar optical substrate comprises
2 separate first and second pieces, said input section being formed in said first
3 piece and said output section being formed in said second piece, said first and
4 second pieces being spaced apart across a gap, and said isolator element being
5 disposed at least partially within said gap.

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1 16. The device of claim 15, wherein said first and second pieces are affixed to a
2 common support substrate.

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1 17. An integrated optical isolator array, comprising:

2 a planar optical substrate;

3 a plurality of waveguides formed in said optical substrate, each one of the
4 plurality of waveguides having an input section and an output section; and
5 an isolator element affixed to said optical substrate and positioned in the
6 optical paths of at least two of said waveguides between said input sections and
7 said output sections, said isolator element being configured to allow the passage
8 of forwardly traveling light from said input sections to said output sections of
9 said at least two waveguides while inhibiting the passage of backwardly
10 traveling light from said output sections to said input sections.

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1 18. The integrated optical isolator array of claim 17, further comprising a trench
2 formed in said optical substrate, said trench being oriented transversely with
3 respect to the longitudinal axes of said plurality of waveguides, and wherein said
4 trench receives and holds a lower end of said isolator element.

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- 1 19. The integrated optical isolator array of claim 17, wherein said isolator
2 element is positioned in the optical paths of all of said plurality of waveguides.
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- 1 20. The integrated optical isolator array of claim 17, wherein said isolator
2 element comprises at least one Faraday rotator layer interposed between
3 birefringent layers.
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- 1 21. The integrated optical isolator array of claim 17, wherein said input sections
2 each include a first taper section for expanding forwardly traveling light from a
3 first mode size to a second mode size.
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- 1 22. The integrated optical isolator array of claim 21, wherein said first taper
2 section is substantially adiabatic.
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- 1 23. The integrated optical isolator array of claim 21, wherein each of said
2 output sections includes a second taper section for contracting forwardly
3 traveling light from said second mode size to a third mode size.
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- 1 24. The integrated optical isolator array of claim 17, wherein a long axis of said
2 isolator element is oriented perpendicular to the optical axes of said plurality of
3 waveguides.
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- 1 25. The integrated optical isolator array of claim 18, wherein said trench extends
2 partially through a thickness of said optical substrate.
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- 1 26. The integrated optical isolator array of claim 18, wherein said optical
2 substrate is affixed to an underlying support substrate, and said trench extends
3 fully through a thickness of said optical substrate and partially into a thickness of
4 said support substrate.

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1 27. The integrated optical isolator array of claim 17, wherein said input and
2 output sections of said plurality of waveguides are formed simultaneously in
3 said optical substrate.

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1 28. The integrated optical isolator array of claim 17, wherein said optical
2 substrate is formed from a glass.

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1 29. The integrated optical isolator array of claim 18, wherein said planar optical
2 substrate comprises separate first and second pieces, said input section being
3 formed in said first piece and said output section being formed in said second
4 piece, said first and second pieces being spaced apart across a gap, and said
5 isolator element being disposed at least partially within said gap.

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1 30. The integrated optical isolator array of claim 29, wherein said first and
2 second pieces are affixed to a common support substrate.